

The Notre Dame HOST::A Hands-On Science and Technology center

(Initial 3-page SAPC Proposal to the Provost at Notre Dame - October 2007)

PURPOSE

The principal aim of HOST is to provide a stimulating environment to all Notre Dame Faculty for the cross-fertilization of ideas and interdisciplinary collaborations in the many areas of research and education in STEM programs –the center will combine the dual efforts of collaborative faculty research, and of its presentation through hands-on exhibits with public access to educate the local statewide, and national community.

INTRODUCTION

We propose to establish a HANDS-ON Science and Technology facility (HOST) at Notre Dame which will be accessible to the general public: this will be developed as part of the Catholic tradition of intellectual understanding for all humankind. We aim to develop **Public Access and Involvement In on-going University research** which can reverse the usual trend that Science research and results are limited almost completely to a very small group of dedicated specialists: here is the opportunity to dynamically enhance the propagation of Notre Dame's research results. The timing is perfect as a natural development of several components and initiatives already in play and which are a vital part of ongoing Science, Technology, Engineering and Mathematics (STEM) research at Notre Dame. The successes of the existing Notre Dame Institutes, with research interests often across several departmental boundaries, require outreach components to justify their continued Federal and other funding. These components are itemized below:

- ▶ In the past five years *Educational Outreach* has increasingly become a key component to most Federal Agency funding and also for State and private Foundation STEM funding.
- ▶ Recent expansion of programs of high-school teachers and students in participating in (mainly summer) research within the Colleges of Science and Engineering, funded through Notre Dame National Science Foundation grants: they are based on the highly successful Notre Dame Quarknet program (\$6M) which has become a model for the whole nation. A new NSF grant supports ND graduate students' educational research in local K-7 science classes. (\$2.7M)
- ▶ Recent expansion of undergraduate research projects in all STEM departments has been a part of the same NSF and DOE-sponsored programs.
- ▶ Saint Mary's College and Notre Dame faculty and staff have coordinated a State of Indiana sponsored Partnership for Professional Development (PD) for hands-on, guided inquiry in science teaching for all K-6 teachers in Mishawaka School City. Through our statewide alliances, we are proposing that this Mishawaka Model (the MM model) be extended across the state, in all K-16 levels. We have introduced the program to South Bend and Mishawaka Middle-school Math and Science Teachers (the MS² program).
- ▶ The University of Notre Dame headed a State of Indiana effort to initiate a 5-year, \$13M, statewide professional development program for high school teachers of Advanced Placement classes. The initial effort failed, but we are likely to succeed in next year's round of applications.
- ▶ Many other Notre Dame programs link research with public outreach components: e.g. the Joint Institute for Nuclear Astrophysics, JINA is linking their research to the local and wider community; the annual FIRST Lego League Robotics tournaments in Electrical Engineering.
- ▶ The Northern Indiana Science, Mathematics and Engineering Collaborative, (NISMEC), primarily a Notre Dame and Saint Mary's STEM outreach group, now represents ISTEM, a State-wide group promoting best-practice (Guided Inquiry) science and math teaching in all grades K-20 to the methods of science research. Together with NISMEC, the Notre Dame

Downtown Center, the Memorial Hospital Foundation and IUSB have active roles in coordinating the local communities and schools in this effort. The faculties of the museums, *Healthworks* and *The Center for History*, will coordinate with us in developing HOST.

► The research program in new presentation techniques at the Jordan Hall of Science DVT (Digital Visualization Theater) is expanding. An alternate location for a Digital Planetarium (DP) that can dedicate its time to outreach for school children and the public is a natural expansion of this program.

APPROACH

A primary vision for the HOST facility is a pro-active educational version of San Francisco's Exploratorium. Current best-practice ideas in teaching are to use hands-on Guided Inquiry in the classroom so that "students" learn as scientists in the laboratory learn and do their research. HOST would become the laboratory for learning using these techniques.

A secondary vision is to enhance the present, necessarily static presentations in the Jordan Hall of Science with active hands-on exhibits at HOST, developed by staff members with input from Notre Dame Faculty. Modern internet communications and other techniques allow direct research involvement: so that these exhibits can be parts of active Notre Dame research programs. For example, Quarknet (high energy physics), Astrophysics (National Telescope programs), and biology research (DNA programs) already utilize such techniques.

The recently established (2004-5) Purdue Discovery Park is another model for the HOST facility. Its principles of internal collaboration, encouragement of innovation, partnerships, entrepreneurship and economic development will also be HOST facility goals. Purdue Professors Lechtenberg, Walker and Staver lead the ISTEM initiative (see above), of which we are a part.

HOST will link the FORMAL education in the classroom (K-20) with the INFORMAL education which takes place everywhere else, but specifically in after-school programs, adult education, public libraries and museums. The captive classroom audience of the former can be contrasted with the voluntary participation of the latter - for example: a successful exhibit must tickle the participant's interest "within 5 seconds". The local resources in both areas are enormous, and can be mutually enhanced by participation at HOST. We have begun these discussions on local and statewide levels.

WHERE WILL THE HOST FACILITY BE? The optimal place to establish HOST will be at or adjacent to the Technology Center being established by the City of South Bend and Notre Dame at the south end of our campus. Parts of some initial operations could take place in the near west-side "museum campus" at Chapin Avenue. The dual Studebaker/Historical Society campus has buildings and rooms (and expertise) in a possible pilot center. Discussions are taking place to coordinate our plans with the *Healthworks* center, operated through the support of the Memorial Hospital Foundation. HOST will be mutually beneficial to these well-established institutions, with a coordinated overlap of areas of STEM research.

HOST PROGRAMS: HOST will develop a synergy between the STEM research at Notre Dame with the research into the best practices of STEM education (Formal and informal), through active ongoing programs in both areas providing continuity and overlap. All STEM Faculty will be encouraged to bring a part of their research into the facility; and to integrate their research in outreach programs through the support of HOST. The participants of this proposal expect to integrate parts of our research into the public access HOST programs: e.g. Programs linking the community with ND research; Distinguished Invited speaker program series; short (week/month) and longer-term research-education visitors; enhance the development of local industry partnerships with faculty research through joint HOST facility programs and exhibits:

coordinate out-of-state science-research field-trips (eg. in biology, geology-dinosaur discoveries, astrophysics -telescope visits, project GRAND, etc); a Digital Planetarium can provide a public output for DVT Notre Dame developed programs with foci on Notre Dame research.

OPERATIONS: HOST will be operated by a small permanent staff including a Director and Operations Director. A Board consisting of STEM Faculty and local leaders will establish priorities and areas of development for HOST. For example, besides overseeing the ongoing operations of HOST, their responsibilities will include the encouragement of all STEM faculty and students to participate on various levels - e.g. with research laboratory equipment, availability of students in their research areas, setting up research partnerships, links with external, particularly local, research sources. The Board will oversee the development of links to local, statewide and national Formal and Informal education projects, including the latest research in these areas.

ANTICIPATED BUDGETARY NEEDS (necessarily approximate and subject to change depending on scale of startup, etc)

Staff of the facility (per year): Director and assistant Director, with faculty rank	\$300,000
Support staff (4)- \$300K 4 graduate & undergrad interns- \$100K	\$400,000
Visiting resident associate (1 per year on semester/summer basis)	\$150,000
Building/addition to the South Bend/Notre Dame Technology center (1 year)	\$500K to \$10M
Major equipment Per Year	\$1M
Establishment of the Digital Planetarium (DP) (1 year)	\$2M
Operating expenses Per Year (1st year planning, etc, costs - add \$100,000)	\$200,000
Stipends for visiting teachers, students & others - PD workshops/year	\$200,000

CONCLUSION: HOST will operate in Notre Dame's Catholic tradition, just as Galileo's transformation expanded the Catholic Church's contributions to universal research and education; and from our own Phil Sakimoto: "The limits of the universe pose no limits to the development and understanding of the human mind". Notre Dame STEM research will have a platform for its productive distribution, worthy of its strengths, and essential to its expansion, and promote substantive support for development of community interactions.

CONTACT PERSON AND PARTICIPANTS

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Saint Joseph County Institutions: Saint Mary's College; IUSB, Ivy Tech, Bethel, Holy Cross; Riverbend Community Math Center; SBCSC, Mishawaka School City, PHM, ETHOS, Memorial Hospital Foundation; St. Joseph Co. Chamber of Commerce; Northern Indiana Historical Society; The Kroc Center; The Apprentice Academy; The Workforce Development Group, SB Community and Economic Development, Daman Products, Studebaker Museum.